

Pole Plate Assembly for a Stator of a Motor

Background of the Invention

1. Field of the Invention

The present invention relates to a pole plate assembly for a stator of a motor. In particular, the present invention relates to a pole plate assembly that has plural stacked pole plates having an increased overall thickness to avoid leakage of magnetic flux and to increase the rotational output torque. In addition, the number of pole faces is arranged in the most effective manner and the overall thickness of the respective pole face is decreased to reduce the radial dimension of the stator.

2. Description of the Related Art

Fig. 7 of the drawings illustrates a conventional stator of a motor. The stator comprises a bobbin 700, two pole plates 710, and an axle tube 720. Each pole plate 710 has two pole ends 711 each having a pole face 712 extending along a plane perpendicular to a generally plane of the respective pole plate 710. The axle tube 720 extends through the pole plates 710 and the bobbin 700 to thereby form a stator having four poles. When electric current is passed through the winding of the stator, the magnetic flux (magnetic lines) created by the winding is guided by the axle tube 720 and to pass through the pole plates 710 to each of the pole faces 712, thereby driving a permanent magnet on a rotor with the magnetic field created on the respective pole face 712. In physical properties, the amount of the magnetization or the magnetic dipole moment of the respective pole plate 710 is constant such that each pole plate 710 is magnetized by the axle tube 720 to a fixed extent. Therefore, the output torque of the stator to the rotor is not substantially increased and the rotational efficiency of the motor is reduced if the number of the pole faces 712 is

1 increased for each pole plate 710. In brief, it is improper to arrange too many
2 pole faces 712 on the respective pole plate 710. On the other hand, a single
3 pole plate 710 cannot assure reliable guide of the magnetic field intensity in
4 the axle tube 720 to the pole plate 710 without leakage of the magnetic flux.
5 Thus, it is theoretically necessary to increase the number of pole plates in
6 order to increase the guide effect of the magnetic flux on the axle tube 720. On
7 the other hand, one must consider the total number of the pole plates while
8 selecting the number of the pole faces on a pole plate so as to determine the
9 most efficient number of the pole faces. For example, when manufacturing a
10 four-pole motor with four pole plates, the most efficient number of the pole
11 face is one (1) for each pole plate, and when manufacturing an eight-pole
12 motor with four pole plates, the most efficient number of the pole faces is two
13 (2).

14 Fig. 8 shows another conventional stator of a motor. The stator comprises
15 a bobbin 800, two pole plates 810, and an axle tube 820. Each pole plate 810
16 includes four pole ends 811 and four pole faces 812 to thereby form a stator
17 having eight poles. Compared with the stator shown in Fig. 7, even the number
18 of the pole ends and the number of the pole faces for the respective pole plate
19 are both increased, it was found that the output torque for driving the motor
20 rotor was not increased significantly, as the sectional thickness of the
21 respective pole plate was not increased at the same time.

22 Summary of the Invention

23 A first object of the present invention is to provide a pole plate assembly
24 for a stator of a motor, wherein the number of the pole plates of the pole plate
25 assembly is increased to increase the total magnetic flux guided through the
26 pole plates, thereby increasing the output torque for driving the rotor.

1 A second object of the present invention is to provide a pole plate
2 assembly for a stator of a motor, wherein the number of each pole plate of the
3 stator plate assembly is selected to be the most efficient to thereby reduce the
4 overall thickness of the respective pole face. The radial dimension of the motor
5 stator is reduced accordingly.

6 A stator in accordance with the present invention comprises a bobbin,
7 plural pole plates, and an axle tube. A half of the plural pole plates is mounted
8 on top of the bobbin and the other half of the plural pole plates is mounted to a
9 bottom of the bobbin. The axle tube is extended through the pole plates and the
10 bobbin to form a stator having four or eight poles. The magnetization is
11 increased and the magnetic flux leakage is reduced by means of the increased
12 overall thickness of the pole plates. The effective guided magnetic flux to the
13 respective pole plate is gained. In addition, the radial dimension of the stator is
14 reduced, as each pole plate is provided with the most efficient number of pole
15 face(s) and the overall thickness of the respective pole face is reduced.

16 Other objects, specific advantages, and novel features of the invention will
17 become more apparent from the following detailed description and preferable
18 embodiments when taken in conjunction with the accompanying drawings.

19 **Brief Description of the Drawings**

20 Fig. 1 is an exploded perspective view of a first embodiment of a stator
21 having a pole plate assembly in accordance with the present invention.

22 Fig. 2 is a top view of the stator in Fig. 1.

23 Fig. 3 is a sectional view taken along line 3-3 in Fig. 2.

24 Fig. 4 is an exploded perspective view of a second embodiment of a stator
25 having a pole plate assembly in accordance with the present invention.

26 Fig. 5 is a top view of the stator in Fig. 4.

1 Fig. 6 is a sectional view taken along line 6-6 in Fig. 5.

2 Fig. 7 is an exploded perspective view of a conventional stator.

3 Fig. 8 is an exploded perspective view of another conventional stator.

4 **Detailed Description of the Preferred Embodiments**

5 Referring to Figs. 1 through 3, a stator in accordance with the present
6 invention generally comprises a bobbin 100, four pole plates 110, and an axle
7 tube 120. An axial winding (not labeled) is wound around the bobbin 100.
8 Preferably, each pole plate 110 includes a single pole end 111 having a single
9 pole face 112 extending along a plane perpendicular to a general plane of the
10 respective pole plate 110. An overall thickness of the pole face 112 of the
11 respective pole plate 110 is not reduced after stacking of the pole plates 110.
12 Preferably, the pole face 112 of the respective pole plate 110 has an inclined
13 side or is configured as a trapezoid to prevent generation of dead angle for
14 starting.

15 In assembly, two of the pole plates 110 are mounted on top of the bobbin
16 100 and the other two pole plates 100 are mounted to the bottom of the bobbin
17 100 with the pole faces 112 of the upper pole plates 110 mounted on top of the
18 bobbin 100 being diametrically opposed to each other and with the pole faces
19 112 of the lower pole plates 110 mounted to the bottom of the bobbin 100
20 being diametrically opposed to each other. Next, the axle tube 120 is extended
21 through the pole plates 110 and the bobbin 100 to form a stator having four
22 poles with the pole faces 112 being spaced at 90° interval. Thus, the overall
23 thickness of the pole plates 110 is increased, as there are two pole plates 110
24 mounted on top of the bobbin 100 and two pole plates 110 mounted to the
25 bottom of the bobbin 100. This increases the contact area between the axle
26 tube 120 and the pole plates 110 for magnetic flux conduction and thus assures

1 increased magnetization by means of reliable guide of the magnetic flux on
2 two ends of the axle tube 120 to the pole plates 110. Leakage of the magnetic
3 flux is thus reduced, and the effective guided overall magnetic flux conducted
4 to the respective pole face 112 is gained. As a result, the output torque for
5 driving the motor rotor is increased. On the other hand, since each pole plate
6 110 has only one pole face 112 (which is the most efficient), the overall
7 thickness of the respective pole face 112 is reduced and the radial dimension
8 D1 (see Fig. 3) of the stator of the motor is reduced in addition to the effective
9 driving for the rotor.

10 Refer to Figs. 4 through 6 illustrating the second embodiment of a stator in
11 accordance with the present invention. In order to eliminate the problem of
12 excessively increased overall thickness of the pole plates when using eight
13 pole plates 110 in the first embodiment to construct an eight-pole stator, in this
14 embodiment, the number of the pole plates 210 is reduced to four, and each of
15 the pole plates 210 has two diametrically opposed pole ends 211 each having a
16 pole face 212 extending along a plane perpendicular to a general plane of the
17 respective pole plate 210.

18 In assembly, two of the pole plates 210 are mounted on top of a bobbin
19 200 and the other two pole plates 210 are mounted to the bottom of the bobbin
20 200 with the pole faces 212 of the upper pole plates 110 mounted on top of the
21 bobbin 200 being alternately disposed and with the pole faces 212 of the lower
22 pole plates 210 mounted to the bottom of the bobbin 200 being alternately
23 disposed. Next, an axle tube 220 is extended through the pole plates 210 and
24 the bobbin 200 to form a stator having eight poles with the pole faces 112
25 being spaced at 45° interval. Compared with the conventional eight-pole stator
26 in Fig. 8 having four-pole-face pole plates 812 and having a diameter of "D8",

1 the overall thickness of the pole plates 210 for conducting the magnetic flux is
2 doubled, as there are two pole plates 210 mounted on top of the bobbin 200
3 and two pole plates 210 mounted to the bottom of the bobbin 200. This
4 increases the magnetization and decreases the magnetic flux leakage. The
5 magnetic flux conducted to the respective pole plate 210 is gained, but the
6 overall thickness of the respective pole face 212 is not increased when
7 compared with the conventional design, as each pole plate 210 has only two
8 pole faces 212. In addition, the radial dimension "D2" (see Fig. 6) of the stator
9 of the motor in accordance with the present invention is equal to that "D8" of
10 the conventional design.

11 Referring to Figs. 1, 4, and 8, the pole plate assembly for a stator of a
12 motor in accordance with the present invention increases the magnetization
13 and reduces the magnetic flux leakage by means of increasing the number of
14 the pole plates. The effective guided overall magnetic flux is gained while
15 each pole plate is provided with the most efficient number of pole face(s) to
16 reduce the total number of the pole faces and the thickness of the respective
17 pole face that are not advantageous, thereby reducing the radial dimension of
18 the motor stator. By contrast, the conventional pole plate assembly for a stator
19 motor increases the pole faces on each pole plate without increasing the
20 overall thickness of the pole plates. The effective guided overall magnetic flux
21 is not increased, as the magnetization of the pole plates is not increased and the
22 magnetic flux leakage is not reduced.

23 Although the invention has been explained in relation to its preferred
24 embodiment as mentioned above, it is to be understood that many other
25 possible modifications and variations can be made without departing from the
26 scope of the invention. It is, therefore, contemplated that the appended claims

1 will cover such modifications and variations that fall within the true scope of
2 the invention.